

WHAT IS CLAIMED IS:

1. A system for preventing/controlling compressor surge in an electrically assisted turbocharger that is coupled to an internal combustion engine comprising:

10 an electric motor disposed around a turbocharger shaft having attached thereto a compressor at one shaft end and a turbine at an opposite shaft end;

an electric motor controller electrically coupled to the electric motor;

15 a memory means electrically coupled to the electric motor controller, the memory means having a multi-dimensional map of compressor surge conditions stored therein; and

at least two sensors electrically coupled to the electric motor controller, the sensors being configured to monitor operating conditions of at least one of the turbocharger and an internal combustion engine coupled thereto;

the electric motor controller further configured to control operation of the 20 electric motor responsive to signals provided from the sensors as correlated to the multi-dimensional map of surge conditions stored in the memory.

2. A system for preventing/controlling compressor surge in an electrically assisted turbocharger that is coupled to an internal combustion engine comprising:

25 an electric motor disposed around a turbocharger shaft to provide rotational movement thereto;

an electric motor controller electrically coupled to the electric motor for controlling the operation of the electric motor;

30 an engine speed sensor electrically coupled to the electric motor controller for sensing the rotational speed of the internal combustion engine;

a turbocharger speed sensing means coupled to the electric motor controller for sensing the rotational speed of the turbocharger shaft; and

5 a memory electrically coupled to the electric motor controller, the memory having a multi-dimensional map stored therein of surge conditions correlating to the speed of the internal combustion engine and to the speed of the turbocharger;
10 the electric motor controller further configured to control the electric motor responsive to the signals provided from the engine speed sensor and from the turbocharger speed sensing means as correlated to the multi-dimensional map of surge conditions stored in the memory.

3. A system for preventing/controlling compressor surge in an electrically assisted turbocharger that is coupled to an internal combustion engine comprising:
15 an electric motor disposed around a turbocharger shaft to provide rotational movement thereto;
 an electric motor controller coupled to the electric motor for controlling rotational movement provided by the electric motor;
 an intake air sensor coupled to the electric motor controller for sensing a
20 volume of air entering the turbocharger;
 a pressure ratio sensor coupled to the electric motor controller for sensing a compressor pressure ratio; and
 a memory electrically connected to the electric motor controller, the memory having a multi-dimensional map stored therein of surge conditions correlating to the
25 volume of air entering the turbocharger and the compressor pressure ratio;
 the electric motor controller further configured to control the electric motor responsive to the signals from the intake air sensor and from the pressure ratio sensor as correlated the multi-dimensional map of surge conditions stored in the memory.

30 4. A method for preventing/controlling compressor surge in an electrically assisted turbocharger that is coupled to an internal combustion engine, the turbocharger including an electric motor disposed around a turbocharger shaft to provide rotational movement thereto, the method comprising the steps of:

- 5 sensing a first parameter indicative of the rotational speed of the internal combustion engine;
- sensing a second parameter indicative of the rotational speed of the turbocharger shaft; and
- controlling the electric motor responsive to said first and second parameters so
- 10 as to avoid surge based on a multi-dimensional map correlating compressor surge conditions to the speed of the internal combustion engine and to the speed of the turbocharger.